

ERGIS Generation Working Group: April 8, 2013

The purpose of the phone call was to discuss how the ERGIS project will represent generator characteristics in the PLEXOS production cost model. The general topics covered were:

- Thermal Generator Properties
- Generator Aggregation
- Hydro Properties

In general NREL's approach is to leverage the large amount of work that went into the EIPC stakeholder process and to leverage the general buy-in that exists on the EIPC assumptions. In some areas NREL believes we have more specific or more accurate information.

Each of the topics above is discussed in more detail below.

Thermal Generator Properties

This section discussed generator heat rates, minimum up and down times, ramp rates, outage characteristics, startup and VO&M costs, and fuel prices.

The group reviewed the minimum up and down times from the EIPC. The group agreed that the EIPC values were reasonable. There was a question of if the 12-hour minimum down time of coal generators larger than 600 MW was reasonable. The group agreed that NREL would monitor the number of short-duration coal unit shut-downs and re-raise the issue if a substantial number are found. NREL will proceed with the current values for the time being.

The group reviewed the generator fuel use as a function of generation level, as given by the EIPC heat rate shapes, for the CT, CC, Coal, and Oil/Gas Boiler generator types. There was discussion of the CT generators not having a minimum generation level or part-load heat rate values. The EIPC assumed that CTs were only used for energy and provided no spinning reserves, so they would rarely be part-loaded. The EIPC also committed the CT generators by default to reduce the required solve times. There was also discussion about the 50% minimum generation level for CC generators. Some members of the EIPC felt that 50% was too high, and sensitivity was performed with CC generators able to decrease output to 14% of maximum capacity (see page 80 of Part 2 of the EIPC final report:

http://www.eipconline.com/uploads/20130103_Phase2Report_Part2_Final.pdf). The 14% minimum generation value was seen as an extremely low value by some of the EIPC members and the ERGIS working group participants. The group agreed to proceed with the 50% minimum generation level. There was also discussion of coal unit retirements, since much of the coal fleet was retired in the EIPC study due to environmental regulations. Depending on decisions regarding capacity expansion and retirements from ERGIS working groups, the coal unit

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properties might not be important because there might be few coal units still operating. On the other hand, minimum generation levels and ramp rates are important when considering wind and solar integration. The working group agreed to use the EIPC generator characteristics for coal units. A similar discussion followed regarding retirement of oil and gas boilers, and the group again agreed to use the EIPC generator characteristics for oil and gas boilers.

The group discussed using EPA CEMS data for the full-load average heat rate where direct matches could be made between the CEMS database and the PLEXOS database and applying heat rates consistent with the overall distribution of heat rates in the CEMS database where direct matches could not be made. The CEMS data is from 2008, and there was discussion of the small coal units (<300 MW) and inefficient units (>11–12 MMBtu/MWh) being more likely to be retired, which would modify the distribution. There was a suggestion that NREL break down the distributions by generator capacity, look at databases on planned plant closures, and create scatter plots of heat rate versus generator capacity.

The group discussed planned and forced outage rates. The EIPC used GADS data, which reports outage rates by unit type and capacity. The group indicated that variations by size were more important than variation by region. The group also suggested that GADS might have outage durations in addition to rates.

The group discussed startup costs and steady-state variable operations and maintenance (VO&M) costs. NREL proposes to use the published lower-bound data from Intertek-APTECH. The group indicated general approval of this approach. There was a question of whether the VO&M rates published by APTECH include the long-term maintenance service agreements that many CT and CC units make. NREL will inquire with APTECH about their methodology.

The group discussed generator ramp rate constraints. Generally ramp rates have not been binding in previous studies due to the 1-hour simulation resolution. The EIPC ramp rates are fixed MW/minute values rather than % of capacity/minute values. The group accepted the proposed ramp rate limits based on % of capacity/minute. NREL will proceed with the proposed values (see slide 13 for the specific values).

The group discussed the treatment of the generator categories of biomass, IC, oil-fueled units, pumped storage, and nuclear. With the notable exception of nuclear each of these categories constitutes a very small fraction of the generation fleet. Oil-fueled units will be treated the same as their gas-fueled counterparts. Nuclear will have a minimum generation level of 95% of its maximum capacity and a 1%/minute ramp rate. NREL will monitor the model results to see how much the nuclear units cycle.

The group discussed fuel prices. NREL proposed using the EIA 2013 Annual Energy Outlook forecast prices for 2020 for natural gas, fuel oil, and coal. The group agreed with this approach. The AEO does not include biomass or nuclear fuel prices. The group agreed to use nuclear fuel

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price of \$0.75/MMBtu and suggested that NREL refer to the DOE Billion Ton Study (http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf) for biomass fuel prices.

Summary of conclusions:

- NREL will proceed by using the EIPC assumptions for generator properties for minimum up and minimum down times, part-load heat rate shapes,
- NREL will explore heat rate distributions by generator type and capacity before proceeding with applying CEMS heat rate distributions to the generators in the PLEXOS database.
- NREL will look into GADS data for more information about outage rates and outage durations by unit type and capacity.
- NREL will inquire with APTECH about whether long-term service agreements are included in the published VO&M costs, particularly for CT and CC units.
- NREL will proceed with the proposed ramp rate limits.
- NREL will monitor the model results to see how much nuclear units cycle.
- NREL will use the EIA 2013 Annual Energy Outlook for coal, natural gas, and coal prices and \$0.75/MMBtu for nuclear fuel prices.
- NREL will review the DOE Billion Ton Study for biomass fuel prices.

Generator Aggregation

This section discussed aggregation of generators to decrease runtimes of the model. Members of the group who were involved in the EIPC study clarified that the EIPC did some aggregation of units below 5–10 MW but still modeled nearly all generators in the EI. The group expressed concern about losing model fidelity due to aggregating units within a plant to the plant level, due to losing heterogeneity in heat rates and difficulty in accurately modeling startup costs and minimum generation levels. The group indicated it would rather simplify the transmission system rather than the models of the generators. Suggestions were made that units with similar cost characteristics (i.e. type and heat rate) might be candidates for consolidation and that small units with capacity less than 100 MW could be aggregated up to the level of 100 MW. The group agreed that aggregating turbines within a single hydro facility was acceptable, but that only small coal units should be aggregated.

The group also discussed committing generators by default to reduce the solve time of the production cost model. The group agreed that the wind, hydro, and nuclear units should be committed. The group also discussed that the EIPC committed the CT units and assigned them a zero minimum generation level and agreed that ERGIS should do the same.

Summary of conclusions:

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- NREL will explore the runtime reductions possible by 1) aggregating hydro units at the same plant and 2) aggregating generator units of the same type at the same plant with capacities below 100 MW. NREL will also explore the runtime reductions possible by committing the nuclear, CT, wind, and hydro units.

Hydro Properties

The group discussed the properties of hydro generators. The group agreed that for hydro units with significant reservoir capacity the hydro units will be economically dispatched with zero minimum generation level and monthly energy limits based on historical generation data. The group discussed the difficulty of modeling hydro units with minimal reservoirs (run-of-river units) and suggested NREL investigate what data is available at the National Hydropower Asset Assessment Program (<http://nhaap.ornl.gov/>) for these types of units.

Summary of conclusions:

- NREL will model hydro units with reservoirs as economically dispatched for electricity, with monthly energy limits based on historical generation data.
- NREL will investigate the data available at the National Hydropower Asset Assessment Program to determine if data is available on run-of-river units.

Next Steps:

The next working group will cover retirements and capacity expansion and will be between April 25, 26, or 29.

Conference call attendees:

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